FORT WAYNE ELECTRIC WORKS

(INCORPORATED)

Manufacturers of the

"WOOD" SYSTEMS

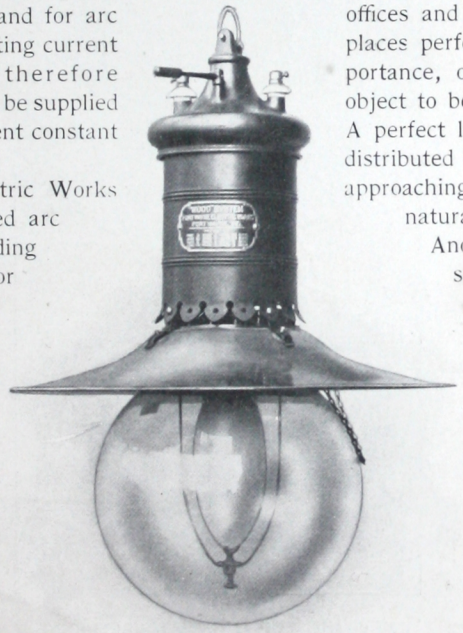
BULLETIN No. 1027 July 7, 1902

ENCLOSED ALTERNATING CURRENT 104 VOLT ARC LAMPS

MULTIPLE TYPE, FORM C

Electric lighting by alternating current has long been an important factor in the business of the central station and because of the flexibility of alternating current systems of distribution has become of equal value with direct current lighting. Wherever incandescent lights are used there is more or less demand for arc lights. The use of alternating current for incandescent lighting therefore means that arc lamps must be supplied for use on alternating current constant potential circuits.

The Fort Wayne Electric Works has for years manufactured arc lamps of all kinds, including alternating current lamps for constant potential circuits and has included in its new line of Form C "Wood" Arc Lamps a lamp of this type that is intended to embody every good point of the older lamps and represent the latest and best of modern arc lighting engineering practice. Every effort has been made to secure that initial perfection of design and construction that ensures the success of a new product of any kind. Although these are new lamps, they represent the result of twenty-three years of experience in the design and construction of arc lamps and arc lighting apparatus. They have been designed with special attention to the distinctive features that alternating current arc lamps must possess in order to be successful. Arc lamps for alternating current constant poteptial circuits are used almost entirely in conjunction with incandescent lamps for lighting interiors of stores, theatres, churches, factories, offices and public buildings. In such places perfect light is of primary importance, of course, and is the first object to be attained by the designer. A perfect light is a steady uniformly distributed and diffused soft light approaching as near as possible to natural daylight.



104 VOLT FORM C LAMP WITH DOUBLE GLOBE AND REFLECTOR

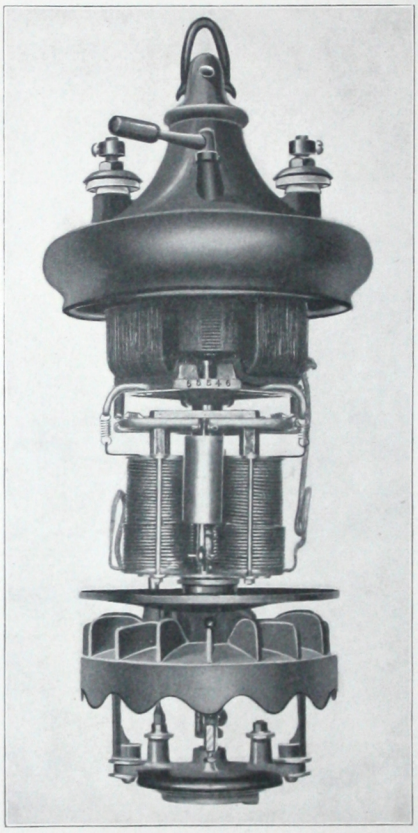
Another important quality that should be possessed by an arc lamp used in such locations is noiseless operation. If a lamp rattles, jars and chatters while feeding it is certainly not properly fulfilling its duty. In a poor alternating current lamp there is often a disagreeable and annoying constant "humming" due to the rapid reversals of the current causing vibrations of the laminations in the core of the reactance coil and magnet which are communicated to the structure of the lamp and magnified as by a sounding board.

In addition to poor light and noises that detract from the value of a lamp that is not first class there is another defect resulting from poor

designing, namely, the generation and dissipation of injurious gases and heat.

These three elementary defects, poor light, noise and gases, are noticeably absent in the new enclosed alternating current 104 volt "Wood" arc lamp. In addition to the absence of these poor qualities, these lamps possess many distinctively superior features that can best be described by enumerating the separate points in detail.

GENERAL PLAN.—The entire lamp is built up on the central brass carbon tube as a foundation. This allows a symmetrical arrangement of the mechanism and also permits the use of a sliding cylindrical case, thus giving access to all sides of the mechanism when the case is lowered. On the upper end of the carbon tube is mounted two brass frames between which is clamped the reactance coil. To the upper frame of the reactance coil the lamp hood casting is bolted by means of the binding post studs. In the lower part of the mechanism chamber a brass casting is attached to the tube. This casting furnishes support to the magnet coils and several adjustments. On the lower end of the carbon tube is mounted the radiator casting, to which is attached all the lower parts of the lamp.



MECHANISM OF ALTERNATING CURRENT 104 VOLT FORM C LAMP.

This method secures a strong and rigid mechanical construction throughout the lamp and renders difficult any distortion of parts by rough handling.

SUSPENSION.—The lamp is suspended by a specially designed link enclosing a porcelain insulator which is held between two suspension ears by a large cotter pin. The suspension link has two downwardly projecting horns that keep the link in an upright position at all times, which makes it easy to hang up the lamp.

HOOD.—The lamp top or hood contains the switch which makes contact with two switch clips on the top frame of the reactance coil. It is made of cast iron, heavily copper plated and then japanned. Since this hood supports the entire lamp the cast iron construction secures rigidity throughout, from suspension ears to gas cap.

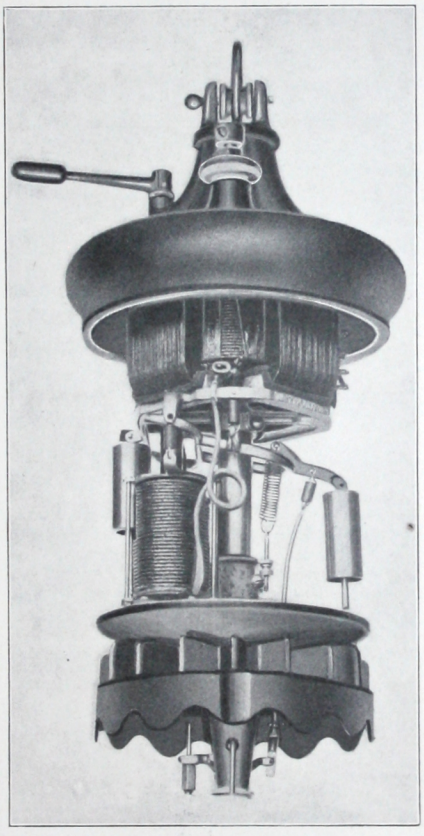
CASE.—The cylindrical case which encloses the mechanism chamber is rolled from heavy sheet copper with but one joint which is lapped, riveted and soldered. This form of case is strong, symmetrical, durable and weather proof. The case is held in place inside the hood by two bayonet catches which are easy to release but positive in holding the case in position. A close fit and the long overhang of the hood ensures a weather tight joint between the case and hood, adapting the lamp to outdoor service as well as interior use.

TERMINALS.—The terminals are on the top of the hood and consist of brass studs that pass through insulated bushed openings in the hood and accommodate screws on their lower ends by which the upper frame of the reactance coil is attached to the hood and to which the inside terminals are fastened. The binding posts are of ample proportions and so located that the wires are placed therein in a vertical position,

thus lessening the liability of broken connections should a screw become loosened. They are provided with porcelain petticoat insulators, capped by a dished brass washer for mechanical protection, and seated on a rubber washer to prevent the entrance of moisture.

MECHANISM.—The operation of this lamp depends on two series solenoids acting on one ⊓-shaped core suspended from one end of a brass frame or beam which is supported from the center of the lower frame of the reactance coil by two springs and which carries on its other end the carbon clutch rod. As the magnet cores are drawn into their coils by a strong current due to a short arc or contact of carbons the opposite end of the beam is raised, carrying with it the clutch rod, clutch and upper carbon. This lengthens the arc, increases the resistance of the lamp circuit, weakens the solenoids and allows the arc to remain at its correct length.

Current regulation is secured by an adjusting screw which varies the tension in the spring opposing the pull of the solenoids.



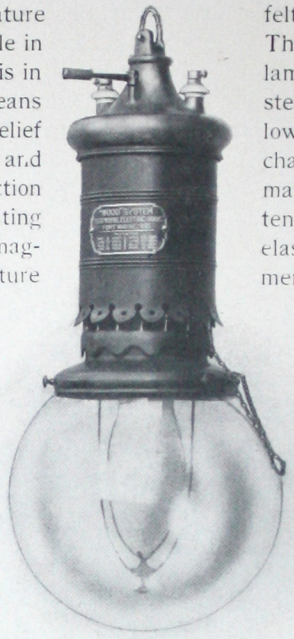
MECHANISM OF ALTERNATING CURRENT 104 VOLT FORM C LAMP.

SERIES MAGNET COILS.—These coils are machine wound on fiber spools with double cotton covered copper wire and shellaced. The spools are then mounted between two brass plates which hold them rigidly in position. The mounted coils are suspended from the lower frame of the reactance coil by two tempered spiral springs. The lower end of the coil is prevented from swinging by being pivoted to a link, one end of which is connected to the dash pot plunger, the other end being pivoted to the stationary casting on the carbon tube. The inside of the spool is partly lined with german silver to reduce friction of armature and spool.

ARMATURE.—The ⊓-shaped solenoid core or armature is built up of thin sheet steel punchings, japanned before assembling to mimimize eddy currents. The laminations are fastened together with german silver rivets, this metal being used on account of its high resistance. The armature is supported on the armature lever by two horizontal spiral springs which mimimize vibration.

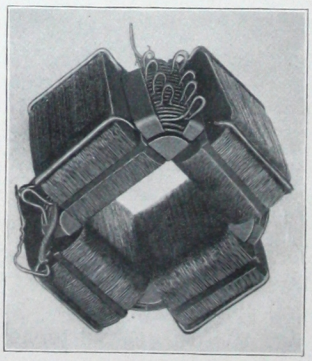
DASH POTS.—On either end of the armature lever is suspended a dash pot, the plungers for both being supported from below. These dash pots act as dampers to the motion of the armature lever and prevent violent action of the mechanism in "picking up" the carbon. The two dash pots exert the same retarding force to the action of the magnets as would one large dash pot of twice the capacity. The use of two dash pots instead of one has an equalizing effect on the armature lever and avoids the distortion and strains that would be imposed on the mechanism by concentrating the entire dampening effect at one point. Since one dash pot must exert a drag while ascending and the other a drag while descending and for various reasons it is best to have both dash pots movable rather than inverting one, an ingenious device is resorted to, to secure this combined effect from two oppositely moving dash pots. This is accomplished by combining with each dash pot a

relief ball valve, that in the armature dash pot being in the plunger while in the carbon rod dash pot the valve is in the end of the dash pot. By this means when the lamp is feeding, the relief valves in both dash pots are open and the carbon is free to drop. This action is further assisted by the adjusting spring acting in opposition to the magnets on the same side of the armature lever with the carbon rod. When the clutch is acting to "pick up" the carbon and lengthen the arc both ball valves are closed and the full retarding effect of both dash pots realized. By these means a quick feed and a slow recovery are secured, insuring a steady light and close regulation. The balls in the valves of the dash pots are made of phosphor bronze and will not be effected by wear or weather.



104 VOLT FORM C LAMP WITH DOUBLE GLOBE

CUSHIONS AND SPRINGS.—In alternating current arc lamps vibration is unavoidable but by good design and the proper construction, the undesirable effects of vibration can be eliminated. The seat of vibration is in the cores of the magnet and reactance coil. From here the vibrations would be taken up and transmitted throughout every part of the lamp with the accompanying rattle and hum, unless preventative measures are taken. In the 104 volt Form C lamp the reactance coil core is clamped between felt covered frames, all moving mechanical connections are made with springs under slight tension instead of cotters, except the dash pot with which cotters packed with felt are used, and every point where hammering is possible is covered with heavy felt. The result is a noiseless lamp. The suspension springs used in this lamp are all oil tempered and japanned steel wire, not subject to rust. The low operating temperature of the mechanism chamber cannot effect the permanency of the springs and the working tension of every spring is far below its elastic limits so that permanent adjustment is assured.



REACTANCE COIL FOR 104 VOLT FORM C LAMP.

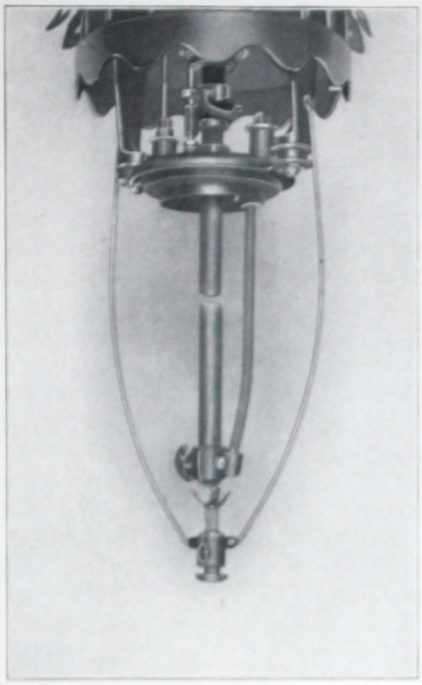
RADIATOR.—In all the new Form C "Wood" arc lamps the cast iron radiator between the mechanism chamber and the globe holder effectively protects the mechanism chamber from excessive temperature due to the heat of the arc. The radiator consists of a cast iron umbrella with radial vanes on its upper surface which furnishes liberal radiating surface. The mechanism chamber is shielded from the heat from the radiator by the intervening air space and the separating plate above it.

The radiator casting is copper plated and japanned and presents a pleasing contrast when compared with the common tin or sheet metal construction of this part of an ordinary arc lamp. Rust or weather cannot affect this construction and years of service will not develop holes in the radiator or separating plate, admitting moisture and dirt to the serious injury of the feeding mechanism of the lamp.

REACTANCE COIL.—The function of a reactance coil in an alternating current arc lamp corresponds to that of a steadying resistance in a constant potential direct current arc lamp. The additional resistance supplied by the coil to that of the arc and

series magnet coils serves to steady the arc voltage and furnishes means of adjusting the lamp for various voltages, while the reactance introduced into the circuit by the iron enclosed coil affords means for adjusting the lamp for various frequencies by changing in a larger degree the number of turns of wire in the circuit. The magnetic circuit is given greater reluctance by interposing an air gap filled with a fibre spacing strip as shown in the illustration on Page 4, which shows the coil and core mounted with temporary clamps on the core.

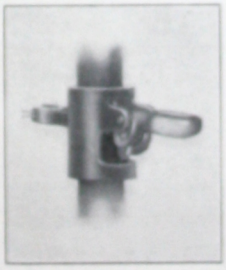
A series of taps are brought out from the coil giving nine adjusting steps for various line voltages and two leads are available for adapting the lamp to 60 or 140 cycle circuits with a variation of 10 per cent either way from each frequency. The range of voltage adjustment covered by the standard reactance coil is from 100 to 120 volts.



PARTS BELOW RADIATOR, 104 VOLT LAMP.

CARBON CLUTCH. — The standard clutch is the pivoted shoe type and is plainly shown in the accompanying illustrations. It is composed of five parts—the body, trip lever, shoe and two pivots. The body of the clutch has four contact points, so that the clutch may be termed a five point clutch, the shoe constituting the fifth point. This clutch permits proper feeding at all times regardless of the size or condition of the surface of carbon. It is solid, substantial, positive in action and cannot get out of order. The tripping post on the gas cap allows adjustment to be made of length of "pick up" of carbon.

CLUTCH, TRIPPING LEVER SIDE.



CLUTCH, SHOE SIDE.

LOWER CARBON HOLDER. The lower carbon holder consists of a ring casting with a copper thumb screw for clamping holder on supporting rod. A small wire bail under the holder prevents the dropping of the carbon should the thumb screw loosen. In trimming this bail is pushed aside while the carbons are being inserted. The supporting rod carrying the lower carbon holder is attached to the gas cap by a set screw and, although rigidly held in alignment, is easily detached.

INNER GLOBE HOLDER. In the design of many arc lamps too little attention is paid to the inner globe holder. In this lamp it consists essentially of a wire bail hanger supporting at its lowest point a casting through which passes a short vertical post. On the top of this post is mounted a small inverted tripod in which rests the closed bottom of the inner globe. Constant pressure is maintained by the tripod against the globe by means of a small oil tempered spiral spring on the post under the tripod.

The small contact of the inner globe holder on the globe is a point that will no doubt be noticed when comparisons are made with other lamps. A large contact of heated metal on heated glass always causes discoloration or breakage of the glass because of overheating or unequal expansion due to uneven heating. The three point

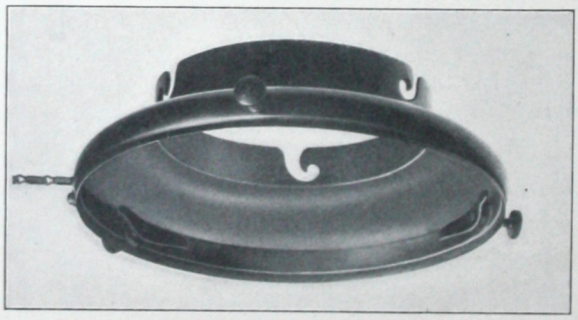
contact of this holder is designed to overcome this cause of trouble. The inner globe is removed for trimming the lamp by drawing down the tripod and releasing the globe. In removing the globe the spiral spring is compressed and any dirt contained in it ejected through the two openings in the casting below, thus preventing the clogging of the spring. No part of the inner globe holder is in circuit, so that there is no danger of receiving a shock while removing the globe. The top of the globe is automatically held in accurate position against the faced surface of the gas cap by the small spring on the inner globe holder post and the arrangement of the bail hanger supports.

UPPER CARBON HOLDER AND TROLLEY.

GAS CAP.—The gas cap is cast iron and is composed of an upper dish-shape casting and an under ring casting, separated by asbestos and mica insulation and clamped together to form a rigid support for the lower carbon holder and inner globe. The structure of the gas cap is such that no difference of potential exists on the exposed upper surface where dust is liable to collect and form a short circuit. This is an important point especially where the lamp is used with no outer globe.

Another valuable feature of construction of the gas cap is one that will save many broken inner globes. The lower part on which the inner globe is seated is but slightly larger in diameter than the globe and therefore is almost entirely protected by the globe against sudden changes in temperature caused by cold draughts of air. The upper part of the gas cap overhangs the lower and further protects it from chills so that the gas cap always has the same temperature as the globe. A very slight change in the temperature of the metal in contact with the globe causes a corresponding change in the temperature of the globe at this point and the result is often as disastrous as a dash of cold water on heated glass. This gas cap will not break globes.

The opening in the center of the gas cap through which the upper carbon passes is lined with a removable copper bushing which will not rust and interfere with the proper operation of the feeding mechanism.



OUTER GLOBE HOLDER.

UPPER CARBON HOLDER.—The upper carbon holder is combined with the trolley which collects current from the carbon tube. It consists of two semi-cylindrical phosphor bronze jaws attached to the lower end of the trolley and having annular contact on the carbon instead of a cylindrical contact. By this means the carbon is kept in good contact with the holder and in free alignment even though the carbon may be crooked or irregular in shape.

The lower end of the trolley body projects downward between the two jaws and serves as a stop for the upper carbon and limits its entrance into the holder to the proper amount. No part of the holder can be effected by the weather or heat from the arc but it is easily detached by removing two screws when necessary. The upper carbon holder and the trolley combined are several times heavier than a single carbon. This is a very desirable feature as the percentage change in the weight supported by the carbon clutch and armature as the carbon is consumed will be comparatively small with a heavy trolley or upper carbon holder and consequently the adjustment of the lamp will not be affected by the consumption of the carbon. This means much

closer regulation of the length of the arc and consequently much better light and more satisfactory operation of the lamp.

TROLLEY.—The construction of the trolley and upper carbon holder can be best understood by reference to the illustration on Page 6. It consists of a solid brass rod machined to the proper shape and dimensions. The body of the trolley has three semi-circular axial grooves milled at 120° with each other. These grooves contain semi-circular phosphor bronze contact springs which project above the surface of the brass cylinder and make edgewise contact with the inside of the carbon tube thus always preserving a bright clean surface on the tube and preventing pitting or corrosion of the tube or contact springs. The contact surface is amply sufficient to carry more than double the normal lamp current without heating. In trimming the carbon is automatically centered by the conical screw plug in the top of the carbon tube which enters a depression in the top of the trolley body.

By the use of a trolley contact for the upper carbon the disadvantages of loose cable connections are avoided; the carbon feeds properly at all times; the trolley and holder are easily removed; there is no useless weight in the carbon tube, and the entire carbon holder and current collecting device is self contained.

OUTER GLOBE HOLDER. — It is well known that glass expands when heated and that the heat from an electric arc is very intense and it necessarily follows that provision must be made in the arc lamp for the expansion of all parts affected by the heat of the arc. The outer globe holder of the new Form C lamp is a decided departure from anything previously produced. It is very solidly constructed of copper with reinforcing bands riveted and soldered on the inside. The globe is clamped in position in the holder by thumb screws which turn in solid nuts mounted rigidly in the holder. On the ends of these screws are phosphor bronze springs that fit the globe and permit the thumb screw to be turned into the globe holder without any danger of cracking the globe. The expansion of the outer globe, due to the intense heat of the arc, is thus amply provided for by this construction. The globe holder is held in position directly under the radiator by means of a bayonet catch and has attached to it a phosphor bronze chain from which it is suspended during the act of trimming as above explained. It is unnecessary to remove any screw or use any tools to remove globe, globe-holder and chain from lamp.

OPERATION.—These lamps are adjusted to operate successfully on constant potential 104 volt alternating current circuits with a current of 6 amperes and 72 volts at the arc but may be adjusted for line voltages from 100 to 120 volts, either 60 or 140 cycles.

CARBONS.—These lamps require one solid and one cored carbon of the highest grade of forced carbon. When so equipped the life of the lamp with one trimming is from 60 to 80 hours, depending on the quality of carbons. In trimming, the unconsumed portion of the cored upper carbon replaces the consumed solid lower carbon and a new solid carbon is inserted in the upper carbon holder. Thus the lamp is always trimmed with one solid and one cored carbon. The diameter of carbons for these lamps must be between .512" and .520". The length of the upper carbon should be 10½" and the lower carbon should be 5½" long.

INTERCHANGEABILITY. — These lamps are built of standard parts that are used in all the Form C arc lamps, with the exception of those parts peculiar to lamps used on alternating current circuits.

ALTERNATING CURRENT 104 VOLT ARC LAMPS, MULTIPLE TYPE, FORM C

CAT. NO.	CODE WORD	Frequency	Amperes	Volts at Arc	CARBONS	
					Cored Upper	Solid Lower
*83239	Bolsaggine	60	6	72	10½"x.512"–.520"	5½"x.512"–.520"
*83240	Bolsas	125–140	6	72	10½"x.512"–.520"	5½"x.512"–.520"

*Catalogue Number does not include case, globes or reflector.

CASES FOR FORM C ARC LAMPS

CAT. NO.	CODE WORD	DESCRIPTION	
81938	Bombardon	Copper, Bauer-Barff Oxidized Finish	
81939	Bombasine	Copper, Plain Lacquered Finish	
81562	Bombast	Brass, Bauer-Barff Oxidized Finish	
81563	Bombastico	Brass, Satin Finish	

GLOBES AND REFLECTORS FOR FORM C ARC LAMPS

CAT. NO.	CODE WORD	DESCRIPTION	DIMENSIONS
83207	Bombizemus	Ball outer globe, clear glass	13"x12½"x7¼"x8¼"
83208	Bomboletta	Ball outer globe, opal glass	13"x12½"x7¼"x8¼"
83209	Bombonne	Ball outer globe, ground glass	13"x12½"x7¼"x8¼"
83210	Bombulio	Ball outer globe, alabaster glass	13"x12½"x7¼"x8¼"
83244	Bonarieta	Closed bottom inner globe, clear glass	3"x7½"x2 1/16"
83245	Bonasorum	Closed bottom inner globe, alabaster glass	3"x7½"x2 1/16"
83236	Bonair	Heavy metal porcelain lined reflector	21"x3"x7½"
83243	Bonancible	Porcelain reflector	21½"x3"x7¼"x8 1/16"

FORT WAYNE ELECTRIC WORKS - - - - - - Main Office and Factory FORT WAYNE, IND.

Branch Offices:

BOSTON, MASS., 518 Exchange Building.
NEW YORK, N. Y., 40 New Street.
PHILADELPHIA, PA., 1100 Penn Sq. Bldg.
SYRACUSE, N. Y., 717 Dillaye Building.
PITTSBURG, PA., 902 Fifth Avenue.
CINCINNATI, OHIO, 402 Neave Building.
GRAND RAPIDS, MICH., 222 Houseman Bldg.
CHICAGO, ILL., 623 Marquette Building.
ST. LOUIS, MO., 818 Lincoln Trust Bldg.
ST. PAUL, MINN., 615 Germania Life Bldg
ATLANTA, GA., 8 South Broad Street.
YOKOHAMA, JAPAN, Bagnall & Hilles.

ARCHER FORT WAYNE